Hydraulic fracturing and water resources: a Texas study

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Dried bed of Lake E.V. Spence, Texas, Aug. 7, 2011

Tony Gutierrez/AP Photo
Storage near end of Oct, 2012: 0.354 Million acre-ft (51%)
Conservation Capacity: 0.695 Million acre-ft

Dried bed of Lake E.V. Spence, Texas, Aug. 7, 2011
Tony Gutierrez/AP Photo
Development – Population Growth:
Barnett: DFW Metroplex
Eagle Ford: I-35 Corridor

x2 in the next 50 years: increase in municipal water use

Semi-conductor plant – Austin, TX
W.A. Parish, Houston area, TX – NRG Energy

Increase in manufacturing and electric water use
What is the impact of hydraulic fracturing on water supplies?

Modified from photo by Devon Energy, 2006
A few numbers….

Total = ~15+ million AF
A few numbers....

2008 Mining consumption:
- Oil and Gas = ~60,000 AF (~36 kAF HF)
- Coal/Lignite = ~20,000 AF
- Aggregates = ~70,000 AF
- Others = ~10,000 AF
- Total = ~160,000 AF

2011 Mining:
- Oil and Gas = ~120,000 AF water use
- HF = ~81,500 AF water use
- HF = ~65,000 AF water consumption

Total = ~15+ million AF
2008, 2011 Water Consumption (thousand AF)

- Oil and Gas
- Coal
- Aggregates
- Others

2011 water use

2008

2011
HF water use

2008: 36 kAF

2011: 81.5 kAF
Permian Basin:
Ogallala A.
Edwards-Trinity A.
BK: Dockum, Capitan, Rustler Aqs

Barnett:
Trinity A.
BK: PZ

Haynesville:
Carrizo-Wilcox A.

Eagle Ford:
Carrizo A.
Gulf Coast Aqs
BK: Wilcox, GC
2008, '10, '11 Water Use (thousand AF)

- Barnett Sh.
- Haynesville Sh. / East Texas TG
- Woodford / Barnett PB / Pearsall Sh.
- Anadarko TG
- Permian Basin TO
- South Texas / Gulf Coast TG

Jump in water use in oil plays
GW/SW split: little known

2006 survey in Barnett:
~60% groundwater

2012 Barnett:
~20% groundwater

2012 Haynesville-ETx:
~70% groundwater

2012 Eagle Ford:
~90% groundwater

2012 Permian B.:
~100% groundwater

Based on ~30% of water use
Based on ~30% of water use

Anadarko:
R/R: 20%
BK: 30%

Midland:
R/R: 2%
BK: 30%

Barnett:
R/R: 5%
BK: 3%

Eagle Ford:
R/R: ~0%
BK: 20%

East Texas:
R/R: 5%
BK: ~0%

Delaware:
R/R: 0%
BK: 80%
Based on ~30% of water use

- Anadarko: ~100%
- Barnett: ~60%
- Midland: ~75%
- Delaware: ~80%
- Haynesville: ~15%
- Cotton Valley: ~60%
- Eagle Ford: ~20%
O&G water use and consumption projections

Preliminary Results
Document in Review

Bureau of Economic Geology

O&G Water Use/Consumption (thousand AF)

O&G Fresh and Brackish Water Use
O&G Fresh Water Consumption

Calendar Year

2010 2020 2030 2040 2050 2060
Historical water use
Carrizo-Wilcox aquifer (state-wide)

Rainfall (mm)

Pumpage ($10^6$ m$^3$/yr)

- Irrigation
- Municipal
- Other

Eagle Ford + Haynesville

Huang et al, 2012
South Carrizo: Historical drawdown to 1999 (irrigation)
### A few Eagle Ford counties

<table>
<thead>
<tr>
<th>County</th>
<th>Census 2010 / Area (mi²)</th>
<th>Total water use in 2008 (kAF)</th>
<th>GW (%)</th>
<th>Max HF Water use (kAF)</th>
<th>Max HF water use (% of 2008 water use)</th>
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<tbody>
<tr>
<td>De Witt</td>
<td>20,097 / 909</td>
<td>6.4</td>
<td>86</td>
<td>2.2</td>
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<td>41</td>
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<tr>
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<td>58</td>
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<td>78</td>
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<td>24</td>
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<td>Webb</td>
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<td>3</td>
<td>4.7</td>
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Large increase in sparsely populated counties because of the low baseline.
Conclusions and final thoughts

- Upstream oil and gas uses little water at the state level
- Aquifers of the Eastern half of the state: limited impact; western half: unknown
- However:
  - Frac water use can have a large impact locally, particularly on groundwater
  - Diffuse, transient pumping, no interlocutor (≠ well field)
  - Population growing in a state where droughts are frequent: competition with other users
- There is a need to develop alternative sources of water (brackish, reuse, etc) and less water-intensive techniques for HF
Reference list